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(54) ADDITIVE AND RECORDING MEDIUM FOR INK JET RECORDING

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a recording medium for ink jet recording, with which an image having a high printing density and chroma is obtained, which is excellent in coping with the realization of a multicolor and high speed printing and in the adaptability to a recording device, has general performances as a material to be recorded and can be used in other recording systems.

SOLUTION: This additive has a polymerization product obtained through the polymerization of 50 to 100 mol% of an alicyclic (meth)acrylic ester and 0 to 50 mol% of a monomer copolymerizable with the above alicyclic (meth) acrylic ester except the above alicyclic (meth) acrylic ester as its effective component and is cationic. This recording medium is prepared by internally adding or coating the above additive for ink jet recording to or onto a support or only by coating the above additive for ink jet recording with no pigment mixed onto the support.

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CLAIMS

[Claim(s)]

[Claim 1] The additive for ink jet record which makes an active principle the polymerization object which carried out the polymerization of the monomer which can be copolymerized except above 50 thru/or 100-mol % and alicyclic (meta) acrylic ester for alicyclic (meta) acrylic ester at 0 thru/or 50-mol % of a rate, and has cationicity.

[Claim 2] The additive for ink jet record according to claim 1 which comes to contain the Nonion nature vinyl monomer as a monomer in which alicyclic (meta) acrylic ester and copolymerization are possible.

[Claim 3] The additive for ink jet record according to claim 1 or 2 which comes to contain a cationic monomer at a rate not more than 20 mol % as a monomer which can be copolymerized.

[Claim 4] the polymerization object which carried out the polymerization of the monomer which can be copolymerized except above 50 thru/or 100-mol % and alicyclic (meta) acrylic ester for alicyclic (meta) acrylic ester at 0 thru/or 50-mol % of a rate -- as a cationic surface active agent and/or a configuration monomer -- a cationic monomer -- 50 thru/or 100-mol % -- the additive for ink jet record according to claim 1 to 3 which comes to mix the polymerization object to contain.

[Claim 5] as a cationic surface active agent and/or a configuration monomer -- a cationic monomer -- 50 thru/or 100-mol % -- the additive for ink jet record according to claim 1 to 4 which is a polymerization object which carried out the polymerization of the monomer which can be copolymerized except alicyclic (meta) acrylic ester or alicyclic (meta) acrylic ester, and the above-mentioned alicyclic (meta) acrylic ester under existence of the polymerization object to contain.

[Claim 6] They are internal or the record medium for ink jet record which comes to carry out coating to a base material about the additive for ink jet record according to claim 1 to 5.

[Claim 7] The record medium for ink jet record which does not mix or blend a pigment but comes to carry out coating only of the additive for ink jet record according to claim 1 to 5 to a base material.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to internal or the additive by which coating is carried out, and the record medium which used it at the record medium used for an ink jet recording method. It is related with the new additive which offers the record ingredient which forms the record image which was excellent in color enhancement in detail with high resolution.

[0002]

[Description of the Prior Art] Before, the ink jet recording method is widely used from the reasons nil why the noise of a development fixation process is small compared with a recording method simplicity [needlessness and a recording device], ease [colorization], and dot impact type etc. In order to raise the absorptivity of ink and to raise image concentration as a record medium for ink jet record, as it is in JP,4-15744,B, the method of making cationic resin contain as a deck-watertight-luminaire-ized agent is learned. Moreover, by the ink jet recording method, in order to raise the ink absorptivity of paper for the purpose of recording an alphabetic character, a graphic form, an image, etc. good and to raise image concentration, the approach (JP,8-216504,A) of carrying out coating of the improvement additive in ink jet fitness which has cationicity to paper etc. is proposed.

[0003]

[Problem(s) to be Solved by the Invention] By the way, a more advanced printability came to be required of coated paper in recent years with remarkable development of the printing technique represented by multiple-color-izing of record, improvement in the speed, elaboration, etc. Therefore, the record medium for ink jet record raises (1) record concentration, and makes a color tone clear. (2) Raise improvement in an ink rate of drying, and the absorption capacity of ink. (3) A dot is circular, there is no breadth and an edge is Sharp. (4) Fixable [of a color] (water resisting property) is good. To fulfill many said properties is needed.

[0004] however, high [printing concentration sufficiently satisfying in a Prior art or high] -- a saturation image is not obtained and it cannot respond to multiple-color-izing of printing, and improvement in the speed enough.

[0005] This invention aims at offering the record medium for ink jet record which also fills military requirements, such as satisfying each above-mentioned military requirement, and excelling in compatibility with ** recording device (generating neither paper powder nor curl), having the general engine performance (reinforcement, printability, etc.) as a ** recorded material, and things (electrophotography record, dot record, etc.) that can be used also for a recording method besides **.

[0006]

[Means for Solving the Problem] In the record medium for ink jet record which forms a record image using the water color ink in which this invention persons contained water soluble dye Alicyclic (meta) acrylic ester (in addition, acrylic ester (meta) means acrylic ester and/or methacrylic ester, and is the same semantics as the following (meta).) In order that the additive for ink jet record which makes an active principle the polymerization object to contain, and has cationicity might manufacture the above-mentioned record medium, it found out that it was

internal or suitable for carrying out coating to the base material.

[0007] This invention alicyclic (meta) acrylic ester Namely, 50 thru/or 100-mol %, The polymerization object which carried out the polymerization of the monomer which can be copolymerized except the above-mentioned alicyclic (meta) acrylic ester at 0 thru/or 50-mol % of a rate is made into an active principle. The additive for ink jet record which has cationicity, Internal or the record medium for ink jet record which comes to carry out coating, and a pigment are not mixed for this additive for ink jet record to a base material, but it is related with the record medium for ink jet record which comes to carry out coating only of this additive for ink jet record to a base material.

[0008]

[Embodiment of the Invention] As an alicyclic (meta) acrylic ester monomer used by this invention Acrylic-acid cyclohexyl, acrylic-acid (meta) 1-methylcyclohexyl, (Meta) Acrylic-acid 2-methylcyclohexyl, acrylic-acid (meta) 3-methylcyclohexyl, (Meta) Acrylic-acid 4-methylcyclohexyl, acrylic acids (meta) 3 and 3, 5-trimethyl cyclohexyl, (Meta) And (meta) a thing called acrylic-acid isobornyl etc. is mentioned, it is dealt with in these, and KISHIRU (meta) acrylate is desirable from the point of a sex and the ease of monomer preparation to cyclo.

[0009] the case where the polymerization object used by this invention is the polymer or copolymer of alicyclic (meta) acrylic ester, and it is a copolymer -- the above-mentioned alicyclic (meta) acrylic ester -- more than 50 mol % -- it is necessary to contain -- more than 80 mol % -- containing -- desirable -- more than 90 mol % -- containing is still more desirable. This is for the concentration of a record image to get worse, when the rate of the above-mentioned alicyclic (meta) acrylic ester in an emulsion polymerization object is less than [50 mol %].

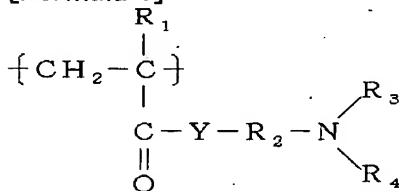
[0010] As an Nonion nature vinyl monomer which can be copolymerized except the above-mentioned alicyclic (meta) acrylic ester For example, ethylene, a butadiene, styrene, alpha methyl styrene, vinyl acetate, Alkyl (meta) acrylate, acrylamide (meta), N-methylol (meta) acrylamide, N and N-dimethyl (meta) acrylamide, methylenebis acrylamide, (Meta) Acrylonitrile, vinylpyridine, vinyl pyrrolidone, 2-hydroxyethyl (meta) acrylate, 2-hydroxypropyl (meta) acrylate, etc. are mentioned, and more than these kinds can be copolymerized in the range which does not spoil the stability of a distributed object.

[0011] In order that the additive for ink jet record of this invention may make alicyclic (meta) acrylic ester an active principle and may raise fixable, it is characterized by having cationicity.

[0012] As a means to make cationicity give the additive for ink jet record of this invention A) How to carry out copolymerization of the cationic monomer to an alicyclic (meta) acrylic ester monomer, B) How to add the cationic matter to the copolymer obtained by copolymerizing the polymer and/or alicyclic (meta) acrylic ester monomer which are obtained by carrying out the polymerization of the alicyclic (meta) acrylic ester monomer, C) -- the bottom of existence of the cationic matter -- alicyclic (meta) acrylic ester -- a polymerization or the approach of copolymerizing, and D -- the approach of performing combining these three sorts of approaches suitably etc. is mentioned.

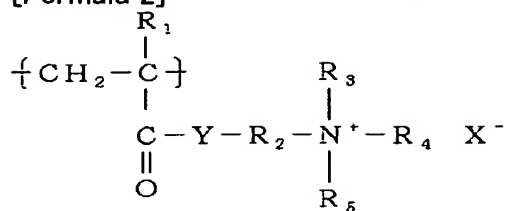
[0013] A) As an approach of carrying out copolymerization of the cationic monomer to an alicyclic (meta) acrylic ester monomer, it is a formula (I). : [0014]

[Formula 1]



(However, as for hydrogen or a methyl group, and R2, R1 shows the alkylene group of C4, or CH2CH(OH) CH2 from C1.) R3 and R4 -- hydrogen or the aliphatic series alkyl group of C1 to C4, a glycidyl group or benzyl, and Y -- O or NH -- being shown -- the monomer which has the third class amino group shown, and formula (II): [0015]

[Formula 2]



(However, as for hydrogen or a methyl group, and R2, R1 shows the alkylene group of C4, or CH2CH(OH) CH2 from C1.) R3, R4, and R5 show hydrogen or the aliphatic series alkyl group of C1 to C4, a glycidyl group, or benzyl. Y shows O or NH. X- shows an anion and is halogen ion, sulfate ion, alkyl-sulfuric-acid ion, alkyl or aryl sulfonic-acid ion, and acetic-acid ion. After carrying out copolymerization of the monomer containing the monomer which has quarternary ammonium salt shown, the approach of copolymerizing, or the third class amino group shown by the alicyclic (meta) acrylic ester monomer and the formula (I), the approach of forming into the fourth class ammonium etc. is mentioned.

[0016] As a monomer which has the third class amino group shown by the formula (I), N and N-dimethylaminoethyl (meta) acrylate, N, and N-diethylaminoethyl (meta) acrylate, N, and N-dimethylaminopropyl (meta) acrylate, N, and N-dimethylamino-2-hydroxypropyl (meta) acrylate, N, and N-dimethylaminopropyl (meta) acrylamide etc. is mentioned.

[0017] As a monomer which has quarternary ammonium salt shown by the formula (II) AKURO yloxy ECHIRUTORI methylanmmonium chloride, (Meta) AKUROIRUOKISHI ethyl dimethylbenzyl ammonium chloride, (Meta) AKURO yloxy ECHIRUTORI ethyl ammonium chloride, (Meta) AKUROIRUOKISHIECHIRU diethyl benzyl ammoniumchloride, (Meta) AKUROIRUOKISHI propyl trimethylammonium chloride, (Meta) AKUROIRUOKISHI propyl triethyl ammoniumchloride, (Meta) 2-hydroxy-3-(meta) AKUROIRUOKISHI propyl trimethylammonium chloride, Acrylamidepropyl trimethylammoniumchloride, (Meta) Acrylamide propyl dimethylbenzyl ammonium chloride, (Meta) (Meta) Acrylamide propyl triethyl ammoniumchloride, acrylamide (meta) propyl JIECHIRUBENJIRU ammoniumchloride, 2-hydroxy-3-(meta) acrylamidepropyl trimethylammoniumchloride, etc. are mentioned.

[0018] Moreover, after carrying out copolymerization to the monomer which contains the third class amino group shown by the alicyclic (meta) acrylic ester monomer and the formula (I) as an approach of forming into the fourth class ammonium after carrying out copolymerization to the monomer containing the third class amino group shown by the formula (I), the approach of adding methyl chloride, epichlorohydrin, benzyl chloride, and a dimethyl sulfate as the fourth class-sized agent is mentioned. In addition, the amount of the fourth class-sized agent used is suitably determined according to the amount of the third class amino group made to form into 4 class.

[0019] Although the additive for ink jet record which has the cationicity of this invention by copolymerizing the above-mentioned cationic monomer with an alicyclic (meta) acrylic ester monomer is obtained, as for the amount of cationic monomers used in this case, it is desirable to consider as more than 0.1 mol % and less than [20 mol %]. This is for raising the printing concentration of the medium for ink jet record by being for raising the water resisting property of the medium for raising and ink jet record, and making fixable [of the ink for ink jet record] into less than [20 mol %] by making the amount of cationic monomers more than 0.1 mol %.

[0020] Although especially a limit is not carried out as an approach of adding the cationic matter, specifically B) Under the polymerization of an alicyclic (meta) acrylic ester monomer Or the approach of adding during copolymerization of an alicyclic (meta) acrylic ester monomer and the Nonion nature vinyl monomer which can be copolymerized except an alicyclic (meta) acrylic ester monomer, How to mix after termination of copolymerization of after termination of the polymerization of an alicyclic (meta) acrylic ester monomer or an alicyclic (meta) acrylic ester monomer, and the Nonion nature vinyl monomer that can be copolymerized except an alicyclic (meta) acrylic ester monomer, The approach of mixing, in case the copolymer of the polymer of an alicyclic (meta) acrylic ester monomer or alicyclic (meta) acrylic ester, and the Nonion nature vinyl monomer that can be copolymerized except an alicyclic (meta) acrylic ester monomer is

added to a record medium etc. is mentioned.

[0021] the copolymerization object and the iii above-mentioned cationic monomer which combined several sorts of i cationic surface active agent, the polymerization object of the ii above-mentioned cationic monomer, or the above-mentioned cationic monomer as cationic matter -- less than [more than 50 100 mol %] -- the copolymerization object which contained and carried out the polymerization of the Nonion nature vinyl monomer which can be copolymerized except the above-mentioned alicyclic (meta) acrylic ester, and iv -- the approach of performing combining these three sorts of approaches etc. is mentioned.

[0022] As a cationic surface active agent used by this invention, dodecyl trimethylammonium chloride, hexadecyl trimethylammonium chloride, octadecyl trimethylammonium chloride, tetradecyl dimethylbenzyl ammoniumchloride, octadecyl dimethylbenzyl ammoniumchloride, etc. are mentioned.

[0023] Alicyclic (meta) acrylic ester under existence of the cationic matter C) As a polymerization or an approach of copolymerizing a) Alicyclic (meta) acrylic ester under existence of a cationic surfactant A polymerization or the approach of copolymerizing, b) Alicyclic (meta) acrylic ester under existence of the copolymerization object which combined several sorts of the polymerization object of the above-mentioned cationic monomer or the above-mentioned cationic monomer A polymerization or the approach of copolymerizing, c) -- the above-mentioned cationic monomer -- less than [more than 50 100 mol %] -- the bottom of existence of the polymerization object to contain -- alicyclic (meta) acrylic ester -- a polymerization or the approach of copolymerizing, and d -- the approach of performing combining these three sorts of approaches etc. is mentioned.

[0024] As for the addition in the case of adding the cationic matter, it is desirable to consider as 1 - 20 weight section to the polymerization object or copolymerization object 100 weight section. This is for printing concentration to fall by making [more] it than 20 weight sections.

[0025] Although a polymerization or copolymerization can be carried out with a well-known polymerization method, in order to use a cationic surface active agent or a cationic monomer, considering as an emulsion polymerization is desirable.

[0026] In addition, the polymerization object of this invention can be manufactured by carrying out the polymerization of the above-mentioned monomer by the well-known approach, and it is also possible to use a chain transfer agent, a reducing agent, a cross linking agent, etc. if needed.

[0027] In order to prevent lowering of the water resisting property of ink jet record, lightfastness, and electrophotography fitness, as for the additive for ink jet record used by this invention, it is desirable to carry out coating to a base material independently, without mixing or blending with a pigment.

[0028] Although paper is mentioned typically, cloth, various resin films like the polyethylene terephthalate resin film used for an over head projector, etc. can also be used that the thing suitable for ink jet record should just serve as a base material of a recorded material in this invention.

[0029] As for the additive for ink jet record used by this invention, 0.05 to 2.5 g/m² and desirable printing concentration sufficient by 0.1 to 1.5 g/m² are discovered by solid content as coverage or an amount of impregnation to a base material. It is possible to use a conventional method as it is as the method of application. That is, size press, a gate roll coater, a blade coating machine, a bar coating machine, a spray, etc. can be used.

[0030]

[Effect of the Invention] Although the reason for demonstrating the effectiveness the additive for ink jet record of this invention excelled [effectiveness] in the color enhancement of a record image in ink jet record is not clear, it thinks in general as follows. Since it has a hydrophilic property, the distributed object which the alicyclic (meta) acrylic ester of this invention carried out the polymerization, and was able to do it is excellent in the absorptivity of water-soluble ink, while it acts as an organic loading material and adsorbs the coloring agent in water-soluble ink well. Moreover, since many of coloring agents used for the water-soluble ink of ink jet record are anionic colors, a color can be made to incorporate and combine and fix inside a

polymerization object by making the additive for ink jet record of this invention into cationicity. It is thought that the additive for ink jet record of this invention is excellent in the color enhancement of a record image in ink jet record for such a reason.

[0031]

[Example] Although an example and the example of a comparison are raised to below and this invention is further explained to it at a detail, this invention is not limited to these examples.

[0032] While putting 95.3g [of cyclohexyl methacrylate], N, and N-dimethylaminoethyl methacrylate 4.7g, 8.3g [of cationic surface active agents] (trade name catiogen L, Dai-Ichi Kogyo Seiyaku Co., Ltd. make), 327.9g [of ion exchange water], 2.3g [of sulfuric acids], and 2-mercaptoethanol 0.5g into an example 1-** stirrer and a reactor with a reflux cooling pipe and blowing and agitating nitrogen gas When it heated and temperature became 60 degrees C, 1.0g (2 and 2'-azobis (2-amidinopropane) dihydrochloride, product made from Wako Pure Chem Industry) of polymerization initiators dissolved in 50g of water was added, and it was kept warm at 70-75 degrees C for 3 hours. The obtained additive was a white emulsion with a mean particle diameter of 116nm.

[0033] While putting N and N-dimethylaminoethyl methacrylate 9.4g, 8.3g [of cationic surface active agents] (trade name catiogen L, Dai-Ichi Kogyo Seiyaku Co., Ltd. make), 325.5g [of ion exchange water], 4.69g [of sulfuric acids], and 2-mercaptoethanol 0.5g into an example 2-** stirrer and a reactor with a reflux cooling pipe and blowing and agitating nitrogen gas When it heated and temperature became 60 degrees C, 1.0g (2 and 2'-azobis (2-amidinopropane) dihydrochloride, product made from Wako Pure Chem Industry) of polymerization initiators dissolved in 50g of water was added, and it was kept warm at 70-75 degrees C for 3 hours. After cooling to 50 degrees C, when 90.6g of cyclohexyl methacrylate was put in, and it heated, blowing and agitating nitrogen gas and temperature became 60 degrees C, 1.0g (2 and 2'-azobis (2-amidinopropane) dihydrochloride, product made from Wako Pure Chem Industry) of polymerization initiators dissolved in 50g of water was added, and it was kept warm at 70-75 degrees C for 3 hours. The obtained additive was a white emulsion with a mean particle diameter of 189nm.

[0034] While putting 58.0g [of cyclohexyl methacrylate], and styrene 28.8g, acrylamidepropyl trimethylammoniumchloride 14.3g, 8.3g [of cationic surface active agents] (trade name catiogen L, Dai-Ichi Kogyo Seiyaku Co., Ltd. make), 324.7g [of ion exchange water], 5.43g [of sulfuric acids], and 2-mercaptoethanol 0.5g into an example 3-** stirrer and a reactor with a reflux cooling pipe and blowing and agitating nitrogen gas When it heated and temperature became 60 degrees C, 1.0g (2 and 2'-azobis (2-amidinopropane) dihydrochloride, product made from Wako Pure Chem Industry) of polymerization initiators dissolved in 50g of water was added, and it was kept warm at 70-75 degrees C for 3 hours. The obtained additive was a white emulsion with a mean particle diameter of 100nm.

[0035] While putting methyl methacrylate 95.2g, N, and N-dimethylaminoethyl methacrylate 4.9g, 16.7g [of cationic surface active agents] (trade name catiogen L, Dai-Ichi Kogyo Seiyaku Co., Ltd. make), 318.1g [of ion exchange water], 3.73g [of sulfuric acids], and 2-mercaptoethanol 0.5g into an example of comparison 2-** stirrer, and a reactor with a reflux cooling pipe and blowing and agitating nitrogen gas When it heated and temperature became 70-75 degrees C, 1.0g (2 and 2'-azobis (2-amidinopropane) dihydrochloride, product made from Wako Pure Chem Industry) of polymerization initiators dissolved in 50g of water was added, and it was kept warm at 70-75 degrees C for 3 hours. The obtained additive was a white emulsion with a mean particle diameter of 257nm.

[0036] While putting 18.8g [of cyclohexyl methacrylate], N, and N-dimethylaminoethyl methacrylate 81.4g, 16.7g [of cationic surface active agents] (trade name catiogen L, Dai-Ichi Kogyo Seiyaku Co., Ltd. make), 306.9g [of ion exchange water], 15.7g [of sulfuric acids], and 2-mercaptoethanol 0.5g into an example of comparison 3-** stirrer, and a reactor with a reflux cooling pipe and blowing and agitating nitrogen gas When it heated and temperature became 70-75 degrees C, 1.0g (2 and 2'-azobis (2-amidinopropane) dihydrochloride, product made from Wako Pure Chem Industry) of polymerization initiators dissolved in 50g of water was added, and it was kept warm at 70-75 degrees C for 3 hours. The obtained additive was a white emulsion

with a mean particle diameter of 119nm.

[0037] When acrylamidepropyl trimethylammoniumchloride 70.0g and 259.3g of ion exchange water were put into the example of comparison 4-**, stirrer, and the reactor with a reflux cooling pipe, and it heated, blowing and agitating nitrogen gas and temperature became 70-75 degrees C, 1.0g (2 and 2'-azobis (2-amidinopropane) dihydrochloride, product made from Wako Pure Chem Industry) of polymerization initiators dissolved in 50g of water was added, and it was kept warm at 70-75 degrees C for 3 hours. The obtained additive was a light yellow transparence solution.

[0038] While putting 24.9g [of acrylic acids], N, and N-dimethylaminoethyl methacrylate 19.8g, cyclohexyl methacrylate 102.4, 16.7g [of sodium dodecylbenzenesulfonate], 315.3g [of ion exchange water], 6.55g [of sulfuric acids], and 2-mercaptoethanol 0.5g into an example of comparison 5-** stirrer, and a reactor with a reflux cooling pipe and blowing and agitating nitrogen gas When it heated and temperature became 70-75 degrees C, 1.0g (2 and 2'-azobis (2-amidinopropane) dihydrochloride, product made from Wako Pure Chem Industry) of polymerization initiators dissolved in 50g of water was added, and it was kept warm at 70-75 degrees C for 3 hours. The obtained additive was a white emulsion with a mean particle diameter of 101nm.

[0039] Coating of the 3 % of the weight water solution of solid content concentration of the additive obtained by example 1-** was carried out to example 1-** basis weight 62.2 g/m2 and the stencil for Stockigt-sizing-degree 0 - 1 second so that it might become desiccation solid content 0.75 g/m2 using a bar coating machine, and the record medium of this invention was produced. The ink jet printer (BJC-600J, product made from Canon) printed and estimated the ink jet record fitness of the above-mentioned record medium. As evaluation criteria, it was prodigal in measurement of printing concentration about the solid printing section of each color, and the tag reflection density meter D186 performed. Moreover, as a waterproof trial, after carrying out the dipping of the sample after printing for 15 minutes into 25-degree C ion exchange water, it was prodigal and concentration was measured with the tag reflection density meter D186. Although the result was shown in a table 1, by applying the additive obtained by example 1-**, printing concentration improved and the water resisting property also improved.

[0040] The additive obtained by example 2-** and example 3-** instead of the additive obtained by example 2-** - 3-** example 1-** was used, and also the record medium of this invention was produced like example 1-**. Assessment of ink jet fitness was performed completely like example 1-**. Although the result was shown in a table 1, by applying the additive obtained by example 2-** and example 3-**, printing concentration improved and the water resisting property also improved.

[0041] It considered as the example of a comparison, using the stencil (basis weight 62.2 g/m2, Stockigt-sizing-degree 0 - 1 second) used for example of comparison 1 example 1-** - 3-** as it is. A result is shown in a table 1.

[0042] The additive obtained by example of comparison 2-** - 5-** instead of the additive obtained by example of comparison 2-** - 5-** example 1-** was used, and also the record medium was produced like example 1-**, and it evaluated. A result is shown in a table 1.

[0043]

[A table 1]

	印字濃度				耐水性			
	黒	黄	青	赤	黒	黄	青	赤
実施例 1	1.49	0.83	1.54	1.38	1.44	0.80	1.47	1.33
実施例 2	1.49	0.85	1.66	1.40	1.45	0.82	1.50	1.35
実施例 3	1.45	0.84	1.53	1.37	1.40	0.82	1.49	1.34
比較例 1	1.30	0.75	1.37	1.16	0.80	0.50	0.87	0.72
比較例 2	1.40	0.79	1.45	1.30	1.25	0.70	1.35	1.22
比較例 3	1.30	0.76	1.35	1.18	0.98	0.65	1.00	1.12
比較例 4	1.33	0.75	1.38	1.15	1.05	0.68	1.26	1.20
比較例 5	1.31	0.74	1.37	1.17	0.82	0.54	0.86	0.71